

Please note at line 4, paragraph 1, the Examiner cites claims “7-77.”

Applicants assume the Examiner means claims 7-11. Please note at line 3, paragraph 5, the Examiner cites claims “7-22.” Applicants again assume the Examiner means claims 7-11. Applicants respectfully request the Examiner to affirm that claims 7-11 were intended. All currently named inventors are inventors of the invention in the pending claims.

Furthermore, the Applicants disagrees with the Examiner’s statement that “*the intermediate product* is deemed to be useful as a *coating* agent for a *metal substrate*.” There is no support for this statement anywhere in the application or claims, nor does the Examiner supply any support for this statement. First, nowhere is the term “intermediate product” used in describing or claiming the invention. Applicants respectfully request the Examiner to clarify what he means or what is the “intermediate product” referenced in the Office Action. Not knowing what the intermediate product is intended to be makes it impossible to understand the Examiner’s reasoning behind the restriction.

Nowhere in the application is there any indication that the invention can be used as a *coating*, even less likely as a coating for a metal substrate. In fact, the application makes it clear that the additive powder is **not** intended to be used as a coating. The primary use of the invented powder mixed with a resin is to be used with **plastics** as the final product. What the application does indicate, however, is that the prior art intumescent compositions have primarily been directed at coatings, and that the primary use of the claimed invention is *not as a coating*.

In contrast, the present invention is directed at an additive powder that can be mixed with a petrochemical compound, e.g., a curable resin. “Curable resins are frequently used in the manufacture of reinforced plastics, fiberglass laminates, reenforced plastics used as plenums and cable trays used for housing electrical wiring. Plastics are also widely used by automobile and aircraft manufacturers.” at page 1, lines 16-19. In other words, the final product is not a coated *metal* substrate, but instead the mixture of the powder and resin is intended to be added to plastics.

Applicants assert that the powder, as claimed, is not intended to be used as a coating for a metal substrate as stated by the Examiner, because the free flowing powder, by itself, has no adherence or adhesion properties. To coat metal additional constituent solvent materials are required. However, this modifications is beyond the scope of this invention, and is not claimed or disclosed.

Applicants respectfully request the Examiner to supply any prior art references that teach or suggest that the invented additive powder, or its equivalents, can be used as a metal coating.

However, what the invention does provide is a flame retarding and smoke suppressing additive powder that when mixed with polymeric compounds, such as resins and plastics provide a flame resistant product.. The powder includes a carbonific material, a heat activated blowing agent, a heat activated halogen material, a phosphate material, and an inorganic material binder to be mixed with a resin. The additive powder, when added to a

thermoplastic, curable or hardenable with resins, forms a mixture where the additive powder is about 20-30%, by weight, of the mixture.

The resin can be styrenic, olefinic, acrylic, cellulosic, polyester, or polyamide such as are commonly used in the manufacture of fiberglass reinforced structures and moldable plastics. It should be clearly understood that the additive powder is not intended to be used as a **metal coating**, and is primary intended use as an **additive** to a **petrochemical compound** such as a plastic.

In paragraph 7, the Examiner indicates that the oath or declaration is defective. However, an oath and assignment were filed by Applicants on September 21, 2000. Copies of the filing and recordation of the assignment are enclosed. Applicants respectfully request the Examiner to acknowledge that this filing of the declaration has been entered.

In paragraphs 8-9, the Examiner rejected claims 1-6, and 12 under 35 U.S.C. 112, second paragraph.

With respect to claim 1, what is claimed is “a heat activated blowing agent, ... and a heat activated halogen material which forms a fire extinguishing halogen gas under heat.” Clearly, the claimed function of the halogen material is forming *a fire extinguishing halogen gas* that replaces oxygen. The blowing agent is primarily melamine, see Page 7, line 9. The primary function of a blowing gas, as is known to those skilled in the art, is to rapidly form a swollen protective char by foaming and swelling into a cellular structure.

The carbonific produces carbon to contribute to the char layer.

The blowing gas foams and swell the charred resin.

The halogen gas extinguishes fire by replacing oxygen.

The phosphate is a catalyst.

The inorganic binder provides adhesion, insulation, and dimensional and structural stability and strength.

The applicants respectfully request the Examiner not to confuse these clearly distinguishable functions, as they are well known in the art.

The fact that the halogen material produces a gas that increases foaming is desirable. The more gas the better. However, those of ordinary skill in the art, would understand the difference between a material expander, i.e., a blowing agent, e.g., carbon dioxide gas, and a fire extinguisher, i.e., a halogen gas. Those of ordinary skill in the art would never confuse an efficient blowing agent with a halogen gas producer, i.e., the halogenated material and the melamine.

Any secondary effect, good or bad, are incidental, and not claimed. It is well known that all chemical compound have different states, effects and function, depending on temperature, pressure, and the presence of other chemicals such as catalysts. Certainly it is not a requirement of the inventor, to deal with and distinguish every possible function that is not claimed, no matter how remote, of a particular material. For that matter, the Applicants are hard pressed to come up with any material which *does not* turn to a gas when

heated by exposure to open flame or high radiant heat, and therefore “acts” like a blowing agent or a gas. Thus, the Examiner’s statement, with all due respect, that “various components can overlap each other in function” is totally irrelevant. Natural physics demands that solids turn to gas when heated, and that various components overlap each other in function. It is well known that any material, under the appropriate temperature and pressure conditions, can be either a solid, a liquid, or a gas, or combinations thereof.

The Examiner provides no evidence that a halogen is a carbon. The fact that it can “act” as a carbonific does not mean that it is. Nowhere, does the application or claims state that “the heat activated blowing agent can act as a carbonific material,” quoting the Examiner, in contrast, see at page 7, lines 8-14 “**Blowing Agent** - *The blowing agent is primarily comprised of melamine. Heat decomposition of the melamine produces ammonia, urea, water, carbon dioxide, etc. These gases act to expand the volume of the resin during combustion. The gases help produce a multicellular foamy resin which insulates and protects the resin and structure from additional heat.*”

Furthermore, this paragraph makes it quite definite that the function of the blowing gas is to foam and provide insulation from heat.

Claims 1 and 12 clarify state “**comprising, by weight.**” Applicant respectfully request the Examiner to explain which word here does not mean weight, or how the claim word “weight” can be interpreted to mean something else, such as volume or units. Anyone with minimal skills in the mathematical arts knows that units are immaterial if the weight is by percentage. Those of ordinary skill in the art would not confuse the meaning

of a claim which recites “*comprising, by weight: 10.0-12.0% of a carbonific, ... 15.5-17.5 of a blowing agent ..., 12-19.0 of a halogen ... , 30-33.4% of a phosphorous containing material ..., 23.5-29.5% of an inorganic material.*”

A claim that would read, as the Examiner seems to suggest, “*comprising, by weight: 10.0-12.0% by weight of a carbonific, ... 15.5-17.5 by weight of a blowing agent ..., 12-19.0 by weight of a halogen ... , 30-33.4% by weight of a phosphorous containing material ..., 22.0-29.5% by weight of an inorganic material,*” seems like prolix, and should be avoided as suggested by M.P.E.P 2173.05(m).

The claims have been amended to overcome the other 112 rejections, and therefore the 112 rejections of dependent claims are also overcome.

In paragraphs 10-11, the Examiner rejected claims 1-6, and 12 under 35 U.S.C. 103(a) as being unpatentable over Vajs et al. and Wortmann et al. (U.S. Patent 4,743,625 and 4,166,743 - “Vajs” and “Wormann”).

Vajs forms a flame-retardant polyurethane product by mixing and reacting a salt-forming compound with an acidic salt-forming compound containing phosphorus in a polyol and/or a polyisocyanate, then reacting the polyol and polyisocyanate. The products may be used for thermal and sound insulation, as a coating agent, as an adhesive for caulking, for cushioning and for molding useful objects.

Vajs at column 4, line 48 and column 5, section 7, discusses a vitrifying material or agent. The definition of vitrify: “To change or make into glass or a

similar substance, especially through heat fusion.” It comes from the Latin vitrum - glass and facere - to make. The Vajs patent in column 5, Section 7, describes: a vitrifying agent which *locks* the intumescent protective layer ... by vitrifying and when exposed to a temperature. Section 8 specifies the vitrifying, glass forming candidate chemicals specifically.

When exposed to excessive heat, as would be understood by one skilled in the art, the fire retardant mixture, as disclosed by Vajs, proceeds through two primary reaction phases. First, an early formation of a char layer intended to slow the oxidative penetration into the foam core substrate, and second, to form a glassy layer of non-combustible vitrified material intended to slow the penetration of radiant heat, i.e., infrared radiation, and contribute to “locking-off” atmospheric oxygen, which should slow the burning or oxidation of the foam core material. However, borates and silicates typically melt together, at relatively low temperatures, to form brittle, fragile matrices. The fragile matrices produced by Vajs’ mixture add no structural integrity to the char layer profile.

In addition, Vajs does not contain an inorganic binder, as claimed, which is suitable for adding to polymeric plastic resins, as claimed, which may be exposed to a fire. Applicants respectfully request which parts at column 4, lines at lines 43-50, “Suitable additives to be added to a product comprise by weight: 7 to 40 parts of ammonium or diammonium phosphate; 17 to 37 parts of pentaerythritol; 17 to 27 parts of dicyandiamide; and 5 to 50 parts of a suitable vitrifying material. In addition, 5 to 50 parts of chlorinated paraffin may be added,” cited by the Examiner, are believed to be the claimed “*inorganic binders*.”

In Vajs, there are no chemicals that can cause constituent reactions which form a relatively thick, insulate, chemically bonded matrix to hold the carbonaceous materials in place using an inorganic binder, as claimed.

An insulative 3-D layer with structural, chemically bonded integrity, as obtained by the claimed powder, provides an interface between the substrate and heat source. This provides a cellular structure which allows cooling through atmospheric convection. After this layer is formed, it enables the invented composition to stand-up to even higher temperatures and greater thermal gradients.

Wortmann describes an intumescent flame-retardant *coating* composition consisting substantially of a *film-forming* agent, an ammonium polyphosphate, one or more substances which are carbonizable under the action of heat, a dispersant, and optionally a filler. The *coating composition* additionally contains an ammonium polyphosphate activator weighing 0.5 to 50% of the weight of ammonium polyphosphate. The activator is constituted by at least one salt which contains water of crystallization which is liberated upon the composition being heated to about 35.degree. C.

M.P.E.P 904.01(c) states that the prior art must be within which the invention claimed is classifiable, the art of Wortmann deals with intumescent coating, and nothing else, Class 252/8.1.

M.P.E.P 2141.01(a) states that to rely on a reference under 35 U.S.C. 103, it must be analogous art. In order to rely on Wortmann as a basis for rejection

of the applicants' invention, Wortmann must be reasonably pertinent to the particular problem of additive intumescent powders. Wortmann produces a liquid. Wortmann can not be used as a powdery mixture, and can certainly not be combined with Vajs which calls for particles (6), see Figure 1.

Furthermore, M.P.E.P states that to ascertaining differences between the prior art and the applicant's claims, the claimed invention as a whole must be considered.

Also, M.P.E.P 904.01(c) states that to be analogous art, Wortmann must either be in the field of Applicants' invention, i.e., additive intumescent powders, or, if not, then be reasonably pertinent to the particular problem with which the Applicant were concerned, in order to be relied upon as a basis for rejection of the claimed invention. Wortmann is not interested in adding a powder to a resin to form a flame resistant plastic. Wortmann does not mix with anything, Wormann only coats. Coating and mixing are mutually exclusive. Therefore, Wortmann satisfies none of the conditions required to make it analogous art.

Wortmann also does contain an inorganic binder. There is not a single instance in all of Wortmann to either the word "inorganic" or the word "binder." The Examiner is respectfully requested to identify which chemical in Wormann is the claimed inorganic binder.

Wortmann does describe an organic filler. *Organic* fillers like ethyl cellulose may assist in the application of a coating material, by thickening a liquid and

imparting a certain degree of thixotropy, or sticking ability, by mechanical entanglement. In a fire insult, these organics smoke and form soot contributing to the carbonific loading.

This is highly undesirable, as stated repeatedly above and in the present application.

Glass fibers aid in modifying a liquid by thickening liquid, however, they **do not** mechanically entangle or bind like the claimed inorganic binder. As is well known in the art, the filler of Wormann does not bind to anything. Upon drying of the coating, the glass fibers set-up a random matrix. Because glasses do not readily bind they cannot assist in the structural integrity of the coating. Commodity glass fibers are typically made from E-glass which dramatically begin to soften at temperatures over 1,240°F.

Petrochemical fires and other fires feed by various fuel sources, both cellulosic and petrochemical, surge over 1,800°F. At these temperatures, the glass of Wormann melts, *degrading* the structural integrity of the coating. The coating then has to rely on the fragile carbonific char for strength which has molten glass eluted over the char. Combining the cellulose and glass fibers provides no possible synergistic benefit when exposed to high radiant heat or open flame.

In addition, those of ordinary skill in the art would not combine the teaching of Vajs and Wortmann.

In fact, the combination of Vajs and Wortmann eclipse each other because they both contain char and water forming constituents when initially exposed to high heat, and both contain certain materials which are intended to assist the char in reducing further combustion after the char formation phase.

However, both lack the claimed inorganic binder of the present invention. Thus, their char is fragile and does not have any dimensional or structural stability. Additionally, that combination does not have the capacity to stand-up to high velocity flame fronts and higher radiant heat gradients.

In summary, the difference between the prior art and the claimed invention can be summarized using the following table.

Material	Claimed	Vajs	Wortmann
Carbonific	10-12	17-37	8-40
Blowing	15.5-17.5	17-27	0-25
Halogen	12-17	5-50	0.0
Phosphate	30-33	7-40-	10-40
Inorganic Binder	23-29	0	0
Vitrifying Material	0	5-50	0
Filler	0	0	0-25
Salt containing Water	0	0	0.1-20
Dispersant	0	0	0-5

It should be obvious the claimed invention includes materials not present in the prior art compositions, and that the prior art compositions have ingredients not present in the invented powder. It is well known in the chemical arts that the absence of certain compounds can have drastic effect on the chemical reactions. Similarly adding ingredients, such as a vitrifying material, filler, salts, and a dispersant will also alter the reaction. One of ordinary skill in the art would realize that the claimed and prior art compounds would have different reactions and are therefore patentably distinct.

The lack of an inorganic binder in Vajs and Wortmann is fatal not only to the question of obviousness, but also, potentially to the user of products manufactured with a Vajs and Wortmann combined compositions.

If Vajs and Wortmann were combined the result would be highly undesirable because the efficiency of their fire retarding action is not improved or enhanced. The char's fragile dimensional and structural integrity is not improved. The ability of the char layer to stay in place when sprayed with a high pressure water hose is not improved because the unbound char is easily dislodgable by water spray or physical rubbing. The fire insulated area would re-ignite on exposure to either recurring or new sources of heat. Afterglow of the substrate, which is often cited as the re-ignition source for extinguished fire to re-ignite, is exposed when the char is dislodged, and the physical characteristics of an unbound fire insulated area has less "basket strength" to

support the underlying and surrounding substrate structure as the char and vitrified materials have no structural mechanical strength.

Certainly, that combination can never give the unexpected result of the claimed invention because neither formula contains an inorganic binder system which reacts in a combustion to form a cementitious matrix, **binding to**, and **encasing** the expanded char layer. This dry cementitious structure binds with the polymeric resin and plastic by means **of mechanical bonding**. It forms a non-heat-reducible structural barrier.

It also forms and contributes to an insulating open cell layer by allowing atmospheric convection and cooling at the heat insult interface.

Furthermore, it adds rigidity and strength to the char.

Moreover, it assists in reflecting infrared radiation radiances by mechanically binding to the polymeric substrate to suppress smoke, and reduce and isolate afterglow from the environment.

To further distinguish over the prior art, it would be useful to described the chemistry that lies behind the claimed invention as would be understood by those of ordinary skill in the art.

The material constituent recipe of the claimed novel inorganic binder system, working in conjunction with the claimed intumescent chemical powders, is the crux of the uniqueness of the present invention.

When a resin is blended with the claimed fire retarding and smoke suppressing powder, the resin mixture elutes upon the particulate constituents during the mixing phase. The constituents are held within the finished plastic substrate by an encapsulating mechanical bond. As would be apparent to one of ordinary skill in the art, this reaction is not possible with the prior art compositions.

Upon exposure to heat, the unique and unexpected, and nonobvious result of the invention is as follows.

As the plastic substrate of the finished product (note, **nowhere metal substrate**) attempts to combust in the presence of high radiant heat or an open flame. The phosphorus containing constituent decomposes at the start of the pyrolyzing process, releasing a strong acid by-product. This phosphoric acid which is formed, dehydrates the pyrolyzing polymer resin and reacts with the alcohol dipentaerythritol carbonic to form initiator based esters. Halogen gases are also formed and liberated from the chlorinated paraffins. This series of reactions and decompositions catalyzes the formation of water and expedites the formation of a char layer.

The blowing agent decomposes yielding large volumes of non-flammable gases and additional char. The calcium aluminate cement of the invention hydrolyzes in the presence of the water, i.e., water vapor is produced in the char forming layer. This breakdown is an exothermic reaction through an anhydrous phase.

The hydrolyzed calcium aluminate cement proceeds through a dissolution and precipitation reaction with the silica flower to form a **hardened cementitious structural matrix**, unobtainable by either Vajs or Wortmann, alone or in combination. This adhesive cement structure stays **intact**, and in contrast with the prior art, **remains stable** during extremely high temperatures, supporting the insulating char layer formed by the intumescent additives in concert with the plastic soot, i.e., chiefly carbon produced by the incomplete combustion of the plastic polymer.

After the reaction cycle is complete, the carbonaceous material, supported by the cementitious barrier structure keep even higher temperatures and high velocity pressure gradients from penetrating the underlying laminate sub-structure. This is a highly desirable effect not possible with the brittle prior art vitrified materials.

Note, this is **not** a typical Portland cement reaction which has a long “gel phase.” Instead, the water, calcium aluminate cement, and silica flower dissolution precipitation reaction occurs very rapidly at elevated temperatures, i.e., elevated kinetics. Neither, Vajs or Wortmann, alone or in combination can ever achieve this unexpected high speed reaction do to the unique combination claimed by the invention.

There is no foundation for the Examiner’s statement, that for the claimed invention, that workable ranges can be determined by routine experimentation. To the contrary, those of ordinary skill in the art of

designing intumescent compositions know that “the development of additives for use with resins remains a highly empirical art. The predictability of the behavior of the final composition is rare to non-existent, see present Application at page 4, lines 6-7.

In contrast the chemistry of Vajs works as follows. When exposed to high radiant heat or open flame, the ammonium polyphosphate decomposes to form phosphoric acid, which lowers the reaction temperature for the conversion of the pentaerythritol to char and water. Some gases are released by the dicyandiamide. The vitrifying material reflects some IR, until it melts into a useless glassy film. As the temperature increases, this film melts and loses stability.

The end result is nothing but a brittle, fragile carbonaceous deposition, which is **inconsistent and non-compliant** with current fire safety engineering and fire sciences requirements.

The chemistry of Wortmann’s coating produces a fire retardant package dispersed into a film forming carrier “agent” with the option of including fillers to modify the paint-like coating mix. Wortmann employs the same acid former and char formation mechanism as described by Vajs, thus, the same disastrous results.

Wortmann includes a salt, containing significant quantities of bound water which is supposed to be liberated in the fire insult scenario. The theory with the bound water salt complex is to cool the insulted coating surface at the

start of the fire insult exposure, while the intumescent stepwise reaction takes place. After the char forms, only this fragile char and small quantities of residual bound water from the salt complex are relied upon to take on higher velocity flame fronts.

However, higher radiant heat gradients, water impact from high pressure hoses and sprinklers, and the possibility the greater fire affected environment in all likelihood will re-ignite the composition, requiring the need for continued fire protection.

The end result of combining Vajs and Wortmann is a material unsuited for today's fire safety requirements.

All rejections have been complied with, and applicant respectfully submits that the application is now in condition for allowance. The applicant urges the Examiner to contact the applicant's attorney at phone and address indicated below if assistance is required to move the present application to allowance.

Respectfully submitted,

By: 

Dirk Brinkman

Reg. No. 36, 450

Attorney for Assignee

Mr. Anthony Camarota,
Avtec Industries
15 Broads Street, Hudson, Ma. 01749
(978) 562-2300

APPENDIX-A
TO RESPONSE TO OFFICIAL ACTION
(DELETIONS IN BRACKETS AND ADDITIONS UNDERLINED)

1. (Amended Once) A flame retarding and smoke suppressing additive powder, comprising, by weight:
 - a carbonific material 10.0-12.0%;
 - a heat activated blowing agent 15.5-17.5%;
 - a heat activated halogen material 12.0- 17.0% which forms a fire extinguishing halogen gas under heat;
 - a phosphate material 30-33.4% which forms water and phosphorous acid when reacting with one or more of the remaining ingredients in the powder under heat; and
 - an inorganic binder 23.5.0-29.5%.
2. (Amended Once) The powder of claim 1 wherein the carbonific material [carbonific material] is selected from the group consisting of dipentaerythritol, [pentaerythritol,] pentaerythritol polyurethane, phenol, triethylene glycol, resorcinol, inositol, sorbitol, dextrin, and starch.
4. (Amended Once) The powder of claim 1 wherein the heat activated halogen material is selected from the group of chlorinated paraffin by weight - 40% and chlorinated paraffin by weight - 70%.
12. (Amended Once) A flame retarding and smoke suppressing additive powder for mixing with resins comprising, by weight:

10.0-12.0% of a carbonific comprising of dipentaerythritol, dipentaerythritol, pentaerythritol, pentaerythritol polyurethane, phenol, triethylene glycol, resorcinol, inositol, sorbitol, dextrin, and [or] starch;

15.5-17.5% of a blowing agent comprising malamine;

12.0-19.0% of a halogen containing materials comprising chlorinated paraffins;

30-33.4% of a phosphorous containing material which is selected from the group consisting of ammonium polyphosphate, tris(2,3-dibromopropyl) phosphate, tris(beta-chloroethyl) phosphate, guanidine phosphate, urea phosphate, melamine phosphate, monoammonium phosphate, diammonium phosphate[;], and mixtures thereof; and

23.5-29.5% of an inorganic material is selected from the group consisting of calcium aluminate cement, silica flour, and glass beads.